

Public release date: 23-Feb-2012

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Invade and conquer: Nicotine's role in promoting heart and blood vessel disease

San Diego, Calif. – Cigarette smoke has long been considered the main risk factor for heart disease. But new research from Brown University in Providence, R.I., shows that nicotine itself, a component of cigarette smoke, can contribute to the disease process by changing cell structure in a way that promotes migration and invasion of the smooth muscle cells that line blood vessels. In particular, invading cells can remodel structures called podosomes, and this leads to further degradation of vessel integrity.

Ultimately, this cellular migration and invasion process gives rise to the formation of vessel-clogging fatty deposits known as plaque – the hallmark of heart and blood vessel disease. The results on the nicotine-podosome link will be presented at the 56th Annual Meeting of the Biophysical Society (BPS), held Feb. 25-29 in San Diego, Calif.

If confirmed in further studies, the finding that nicotine itself promotes vessel damage by changing podosomes appears to question the health benefits of helping people quit smoking through smokeless nicotine delivery agents such as gum or patches.

"The finding that nicotine is as effective as cigarette smoke in enhancing cellular structural changes, and breakdown of scaffold proteins by vascular smooth muscle cells, suggests that replacing cigarette smoking by nicotine treatment may have limited beneficial effects on atherosclerosis," notes lead researcher Chi-Ming Hai, professor of medical science in the department of molecular pharmacology, physiology, and biotechnology at Brown University.

Hai's research illuminates the multistep process of plaque formation, and suggests that a new powerful player, nicotine, may be involved. The plaque formation process begins as a response to cellular injury, and progresses to destructive and chronic inflammation of the vessel walls that attracts mobs of white blood cells, further inflaming the vessels. This damage-causing inflammation can be triggered by chemical insults from high blood sugar, modified low-density lipoproteins (LDL, the "bad cholesterol"), physical stress from high blood pressure, or chemical insult from tobacco smoke. Now nicotine itself appears to remodel key structures in a way that primes and enhances the invasion of smooth muscle lining the vessel wall.

Identifying a possible nicotine-podosome link in the invasion step of plaque formation process suggests a new means of intervening in the process: targeting the cell structures that are changed by nicotine and that promote invasion of the smooth muscle lining the vessel wall. If a therapy could prevent, slow, or reverse that step, it would likely interrupt the plaque-production cycle.

Fatty deposits accumulate in blood vessels beginning as young as age 10 and progress over a person's lifetime. Heart disease results if the deposits continue to build and harden into vessel-clogging plaque. When plaque ruptures, it can block blood flow, starving the heart or brain of oxygen and leading to a heart attack or stroke.

The presentation, "Cigarette smoke and nicotine-induced remodeling of actin cytoskeleton and extracellular matrix by vascular smooth muscle cells," is at 1:45 p.m. on Sunday, Feb. 26, 2012, in the San Diego Convention Center, Hall FGH. ABSTRACT: <http://tinyurl.com/73e836j>

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This news release was prepared for the Biophysical Society (BPS) by the American Institute of Physics (AIP).

ABOUT THE 2012 ANNUAL MEETING

Each year, the Biophysical Society Annual Meeting brings together over 6,000 research scientists in the multidisciplinary fields representing biophysics. With more than 4,000 poster presentations, over 200 exhibits, and more than 20 symposia, the BPS Annual Meeting is the largest meeting of biophysicists in the world. Despite its size, the meeting retains its small-meeting flavor through its subgroup meetings, platform sessions, social activities, and committee programs.

The 56th Annual Meeting will be held at the San Diego Convention Center (111 W. Harbor Drive, San Diego, CA 92101), located three miles from the San Diego International Airport and less than one mile from the Amtrak station. The San Diego Trolley has two stops directly in front of the Center at Harbor Drive/First Avenue and Harbor Drive/Fifth Avenue.

QUICK LINKS

Meeting Home Page: <http://www.biophysics.org/2012meeting/Main/tabid/2386/Default.aspx>

Housing and Travel Information:

<http://www.biophysics.org/2012meeting/AccommodationsTravel/HotelInformation/tabid/2479/Default.aspx>

Program Abstracts and Itinerary Planner: <http://www.abstractsonline.com/plan/start.aspx?mkey=%7B5B4BAD87%2D5B6D%2D4994%2D84CE%2DB3B13E2AEAA3%7D>

PRESS REGISTRATION

The Biophysical Society invites credentialed journalists, freelance reporters working on assignment, and public information officers to attend its Annual Meeting free of charge. For more information on registering as a member of the press, contact Ellen Weiss, Director of Public Affairs and Communications (eweiss@biophysics.org, 240-290-5606), or visit <http://www.biophysics.org/2012meeting/Registration/Press/tabid/2477/Default.aspx>.

ABOUT BPS

The Biophysical Society (BPS), founded in 1956, is a professional scientific society established to encourage development and dissemination of knowledge in biophysics. The Society promotes growth in this expanding field through its annual meeting, monthly journal, and committee and outreach activities. Its 9000 members are located throughout the U.S. and the world, where they teach and conduct research in colleges, universities, laboratories, government agencies, and industry. For more information on the Society or the 2012 Annual Meeting, visit www.biophysics.org.

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